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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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MOTOROLA, INC.
1303 EAST ALGONQUIN ROAD
IL01/3RD
SCHAUMBURG, IL 60196

EXAMINER	
PERILLA, JASON M	

ART UNIT	PAPER NUMBER
2634	

DATE MAILED: 11/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/882,840	BAUM ET AL.	
	Examiner	**Art Unit**	
	Jason M Perilla	2634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 June 1978*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/15/01*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-48 are pending in the instant application.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on June 15, 2001 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Specification

3. The abstract of the disclosure is objected to because the reference to the apparatus (30) should be a reference to the apparatus (300) of figure 3. Further, in line 7, "the present invention spectrally efficient" should be replaced by –the present invention is spectrally efficient. Correction is required. See MPEP § 608.01(b).

Claim Objections

4. Claims 6, 8, 18, 22, 28-30, and 38 are objected to because of the following informalities:

Regarding claim 6, in line 2, "on the single OFDM prior" should be replaced by –on the single OFDM symbol prior--.

Regarding claim 8, the claim includes the step of "determining an angle for a maximum differential correlation" in lines 2-3. However, the language is nearly indefinite, and it is suggested by the Examiner that the phrase "determining an angle for a maximum differential correlation" is replaced by –determining an angle of a maximum differential correlation--.

Regarding claim 18, the same objection as applied to claim 8 above applies.

Regarding claim 22, in line 2, "on the single OFDM prior" should be replaced by –on the single OFDM symbol prior--.

Regarding claim 28, in line 1, "the integer subcarrier frequency synchronizer" is lacking antecedent basis. It is suggested by the Examiner that the claim should be based upon claim 27 as a parent claim rather than claim 25.

Regarding claim 29, in line 2, "the integer subcarrier frequency synchronizer" is lacking antecedent basis. It is suggested by the Examiner that the claim should be based upon one of either claims 27 or 28 as a parent claim rather than claim 25.

Regarding claim 30, in line 1, "the subcarrier rotation synchronizer" is lacking antecedent basis. It is suggested by the Examiner that the claim should be based upon claim 29 as a parent claim rather than claim 25. Further, the same objection as applied to claim 8 above applies.

Regarding claim 38, the same objection as applied to claim 8 above applies.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-3, 9-12, 14, 25, 26, and 31-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Schmidl et al (US 5732113 – June 15, 2001 IDS reference "AA"; hereafter "Schmidl").

Regarding claim 1, Schmidl discloses a method comprising the steps of: receiving by receiver 120 of figure 5 a single orthogonal frequency division multiplexed (OFDM) symbol (fig. 6, ref. 134) that exhibits 1/N symbol symmetry (col. 8, lines 48-59; col. 12, lines 49-65), where N is an integer equal to 2 ("half-symbol symmetry"; col. 12, lines 49-65); determining timing synchronization (col. 5, lines 37-47; col. 9, lines 13-16; col. 14, lines 17-25) from the single OFDM symbol (col. 14, lines 26-30; col. 14, lines 40-45) by applying a correlation metric to the single OFDM symbol (col. 14, lines 26-37; col. 14, line 45 - col. 15, line 50).

Regarding claim 2, Schmidl discloses the limitations of claim 1 as applied above. Further, Schmidl discloses the step of determining a fractional subcarrier frequency offset from the single OFDM symbol (col. 9, lines 17-22; col. 17, lines 40-60; col. 19, lines 55-65). Although Schmidl discloses that the full frequency offset synchronization (fractional and integer) is performed using samples from both the first (fig. 6, ref. 134) and second (fig. 6, ref. 136) timing symbols, the partial or fractional frequency part of the frequency synchronization may be made by the first timing symbol alone (col. 17, lines 55-62).

Regarding claim 3, Schmidl discloses the limitations of claim 2 as applied above. Further, Schmidl discloses the step of removing the fractional subcarrier frequency offset from the single OFDM symbol (col. 18, lines 5-19; col. 19, lines 55-65).

Regarding claim 9, Schmidl discloses the limitations of claim 1 as applied above. Further, Schmidl discloses the step of utilizing at least the timing synchronization to provide synchronized output symbols in subsequently received bauds (col. 20, lines 38-68). Schmidl discloses that once the timing corrections are made, they are applied to the future received frames.

Regarding claim 10, Schmidl discloses the limitations of claim 1 as applied above. Further, Schmidl discloses the step of determining comprises the step of utilizing the correlation metric to update a previously determined timing synchronization (col. 17, lines 62-68). Schmidl discloses that the updated timing information is used during a tracking mode. The use of a tracking mode relates to the function of updating a previously determined timing synchronization with *new* timing information gathered from the latest synchronization symbol or baud of the latest frame.

Regarding claim 11, Schmidl disclose the limitations of claim 1 as applied above. Further, Schmidl discloses that the single OFDM symbol (fig. 6, ref. 134) is an OFDM sync baud or training symbol (col. 8, lines 40-60).

Regarding claim 12, Schmidl discloses the limitations of claim 1 as applied above. Further, Schmidl discloses that the single OFDM symbol comprises at least one data symbol or one PN sequence (fig. 6, ref. 134 – "PN Seq. 1"; col. 12, lines 49-65).

Regarding claim 14, Schmidl discloses the limitations of claim 1 as applied above. Further, Schmidl discloses that the method is performed by a wireless or broadcast receiver (fig. 5; col. 11, lines 23-42).

Regarding claim 25, Schmidl discloses an apparatus comprising (fig. 5): a timing synchronizer (col. 14, lines 10-25), arranged and constructed to obtain timing synchronization on a single orthogonal frequency division multiplexed (OFDM) symbol (col. 11, lines 7-10); a fractional subcarrier frequency synchronizer (fig. 5; col. 9, lines 17-22; col. 19, lines 50-65), operably coupled to the timing synchronizer, wherein the fractional subcarrier frequency synchronizer is arranged and constructed to obtain fractional subcarrier frequency synchronization on the single OFDM symbol (col. 17, lines 40-62; col. 18, lines 5-20 and lines 38-41; col. 19, lines 55-65). Both the timing synchronizer and the fractional subcarrier frequency synchronizer are embodied by the synchronizer apparatus (120) of figure 5 by Schmidl. Further, Schmidl discloses that if the phase difference or fractional offset Φ is less than the value of π, the second OFDM training symbol is not needed (col. 17, lines 55-63).

Regarding claim 26, Schmidl discloses the limitations of claim 25 as disclosed above. Further, Schmidl discloses that the fractional subcarrier frequency synchronizer is further arranged and constructed to remove a fractional subcarrier frequency offset from the single OFDM symbol (col. 18, lines 5-19; col. 19, lines 55-65).

Regarding claim 31, Schmidl discloses the limitations of claim 25 as applied above. Further, Schmidl discloses a fourier transformer that converts the single OFDM symbol to a frequency domain signal (fig. 5, ref. 126; col. 20, lines 8-20).

Regarding claim 32, Schmidl discloses the limitations of claim 25 as applied above. Further, Schmidl discloses that the single OFDM symbol (fig. 6, ref. 134) is an OFDM sync baud or training symbol (col. 8, lines 40-60).

Regarding claim 33, Schmidl discloses the limitations of claim 25 as applied above. Further, Schmidl discloses that the apparatus is disposed in a wireless or broadcast receiver (fig. 5; col. 11, lines 23-42).

7. Claims 1-6, 9, 11-16, 19-28, and 31-37 are rejected under 35 U.S.C. 102(e) as being anticipated Moose et al (US 6459745; hereafter "Moose").

Regarding claim 1, Moose discloses a method comprising the steps of: receiving (fig. 5, ref. 501; col. 4, lines 1-15) a single orthogonal frequency division multiplexed (OFDM) symbol (col. 1, lines 50-55) that exhibits 1/N symbol symmetry (col. 1, lines 55-65), where N is an integer greater than or equal to 2 (fig. 3, refs. 304, 306; col. 3, .lines 5-10; col. 3, lines 22-26); determining timing synchronization (fig. 5, ref. 506; col. 4, lines 17-21) from the single OFDM symbol by applying a correlation metric to the single OFDM symbol (fig. 6A, ref. 606; col. 4, lines 17-26).

Regarding claim 2, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses the step of determining a fractional subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 5, lines 8-12).

Regarding claim 3, Moose discloses the limitations of claim 2 as applied above. Further, Moose discloses the step of removing the fractional subcarrier frequency offset from the single OFDM symbol (col. 6, lines 40-44).

Regarding claim 4, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses the step of determining an integer subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 6, lines 19-27).

Regarding claim 5, Moose discloses the limitations of claim 4 as applied above. Further, Moose discloses that the step of determining the integer subcarrier frequency offset comprises the step of applying differential correlation to a frequency-shifted version of the single OFDM symbol (fig. 6B, ref. 622; col. 6, lines 5-20).

Regarding claim 6, Moose discloses the limitations of claim 4 as applied above. Further, Moose discloses the step of performing a fourier transform (fig. 6B, ref. 618) on the single OFDM symbol (fig. 6B; ref. 618 – "FTR1") prior to determining the integer subcarrier frequency offset (fig. 6B, ref. 622).

Regarding claim 9, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses the step of utilizing at least the timing synchronization to provide synchronized output symbols in subsequently received bauds (col. 6, lines 40-45).

Regarding claim 11, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses that the single OFDM symbol (fig. 3, ref. 204) is an OFDM sync baud or symbol (col. 1, lines 50-65).

Regarding claim 12, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses that the single OFDM symbol comprises at least one data symbol or random information (col. 1, lines 58-62).

Regarding claim 13, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses that not only may the timing symbol have ½ timing symmetry, but a greater number (3 or more) of identical fractional parts may be used (col. 3, lines 9-12).

Regarding claim 14, Moose discloses the limitations of claim 1 as applied above. Further, Moose discloses that the method is performed by a wireless receiver or RF receiver (col. 4, lines 1-15).

Regarding claim 15, Moose discloses a method comprising the steps of: receiving (col. 4, lines 1-15) a single orthogonal frequency division multiplexed (OFDM) symbol (col. 1, lines 50-55); determining timing synchronization from the OFDM symbol (fig. 5, ref. 506; col. 4, lines 17-21); determining a fractional subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 5, lines 8-12); removing the fractional subcarrier frequency offset from the single OFDM symbol (col. 6, lines 40-44); determining an integer subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 6, lines 19-27).

Regarding claim 16, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses that the step of determining the integer subcarrier frequency offset comprises the step of applying differential correlation (fig. 6, ref. 606; col. 4, lines 22-25; col. 5, lines 1-12) to a frequency-shifted version (col. 4. lines 44-46) of the single OFDM symbol.

Regarding claim 19, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses the step of utilizing at least one of the timing synchronization, the fractional subcarrier frequency offset, and the integer subcarrier frequency offset to provide synchronized output symbols in subsequently received bauds (col. 6, lines 40-45).

Regarding claim 20, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses the step of utilizing at least one of the timing synchronization, the fractional subcarrier frequency offset, and the integer subcarrier frequency offset to update previously determined synchronization information (col. 6, lines 40-45).

Regarding claim 21, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses that the single OFDM symbol exhibits 1/N symbol symmetry, where N is an integer greater than or equal to 2 (fig. 3, refs. 304, 306; col. 1, lines 55-65; col. 3, .lines 5-10; col. 3, lines 22-26).

Regarding claim 22, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses the step of performing a fourier transform (fig. 6B, ref. 618) on the single OFDM symbol (fig. 6B; ref. 618 – "FTR1") prior to determining the integer subcarrier frequency offset (fig. 6B, ref. 622).

Regarding claim 23, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses that the single OFDM symbol (fig. 3, ref. 204) is an OFDM sync baud or symbol (col. 1, lines 50-65).

Regarding claim 24, Moose discloses the limitations of claim 15 as applied above. Further, Moose discloses that the method is performed by a wireless receiver or RF receiver (col. 4, lines 1-15).

Regarding claim 25, Moose discloses an apparatus (fig. 5, ref. 50) comprising: a timing synchronizer (fig. 5, ref. 506), arranged and constructed to obtain timing synchronization (fig. 5, ref. 506; col. 4, lines 17-21) on a single orthogonal frequency

division multiplexed (OFDM) symbol (col. 1, lines 50-55); a fractional subcarrier frequency synchronizer (fig. 5, ref. 506), operably coupled to the timing synchronizer, wherein the fractional subcarrier frequency synchronizer is arranged and constructed to obtain fractional subcarrier frequency synchronization on the single OFDM symbol (col. 4, lines 17-25 and lines 63-66; col. 6, lines 40-45). The "Frequency/Timing Recovery" block (fig. 5, ref .506) performs both the functions of timing synchronization as well as fractional subcarrier frequency synchronization.

Regarding claim 26, Moose discloses the limitations of claim 25 as applied above. Further, Moose discloses that the fractional subcarrier frequency synchronizer is further arranged and constructed to remove a fractional subcarrier frequency offset from the single OFDM symbol (col. 6, lines 40-45).

Regarding claim 27, Moose discloses the limitations of claim 25 as applied above. Further, Moose discloses an integer subcarrier frequency synchronizer (fig. 5, ref. 506; col. 4, lines 44-68; col. 6, lines 19-27), operably coupled to the fractional subcarrier frequency synchronizer, wherein the integer subcarrier frequency synchronizer is arranged and constructed to obtain integer subcarrier frequency synchronization on the single OFDM symbol (col. 6, lines 40-45).

Regarding claim 28, Moose discloses the limitations of claim 25 as applied above. Further, Moose discloses that the integer subcarrier frequency synchronizer is arranged and constructed to apply a differential correlation to a frequency-shifted version of the single OFDM symbol (col. 6, lines 18-20).

Regarding claim 31, Moose discloses the limitations of claim 25 as applied above. Further, Moose discloses a fourier transformer that converts the single OFDM symbol to a frequency domain signal (fig. 5, ref. 508).

Regarding claim 32, Moose discloses the limitations of claim 25 as applied above. Further, Moose discloses that the single OFDM symbol (fig. 3, ref. 204) is an OFDM sync baud or symbol (col. 1, lines 50-65).

Regarding claim 33, Moose discloses the limitations of claim 25 as applied above. Further, Moose discloses that the apparatus is disposed in a wireless receiver or RF receiver (col. 4, lines 1-15).

Regarding claim 34, Moose discloses a method comprising the steps of: receiving (fig. 5, ref. 501; col. 4, lines 1-15) a single orthogonal frequency division multiplexed (OFDM) symbol (col. 1, lines 50-55); determining an integer subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 6, lines 19-27) by applying a differential correlation metric to the OFDM symbol (col. 6, lines 18-21 and lines 40-44).

Regarding claim 35, Moose discloses the limitations of claim 34 as applied above. Further, Moose discloses the step of removing a fractional subcarrier frequency offset from the single OFDM symbol prior to the determining step (col. 4, lines 44-68; col. 5, lines 8-12 and lines 34-35).

Regarding claim 36, Moose discloses the limitations of claim 34 as applied above. Further Moose discloses that the step of determining the integer subcarrier frequency offset comprises the step of applying the differential correlation metric to a

frequency-shifted version of the single OFDM symbol and a known OFDM sync baud (col. 6, lines 20-26).

Regarding claim 37, Moose discloses the limitations of claim 34 as applied above. Further, Moose discloses that the integer subcarrier frequency offset is found at a subcarrier shift resulting in a maximum *or single sharp peak* for the differential correlation metric (col. 6, lines 20-26).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 7, 8, 10, 17, 18, 30, 38, and 41-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moose.

Regarding claim 7, Moore discloses the limitations of claim 1 as applied above. Although the method of Moore discloses corrections for timing synchronization, fractional frequency synchronization, and integer frequency synchronization, subcarrier rotation or phase distortion is cited (col. 5, lines 14-18), but is not explicitly described as being corrected by the disclosure of Moose. However, the inherent relationship between frequency and phase is well known by one having skill in the art. Further, although it is not explicitly stated by Moose, it is inherent that the phase error or subcarrier rotation of the subcarriers would be *at least partially* determined and corrected by the determination and correction of the frequency error of the subcarriers.

One skilled in the art would clearly interpret that the precise correction of the frequency error of the subcarriers as described by Moose would be carried out such that the phase error of the subcarriers would be corrected as well. The determination of the subcarrier frequency offset is a determination of the subcarrier phase offset, and the correction of the subcarrier frequency offset is a correction of the subcarrier phase offset. Therefore, it would have been obvious (if it is not already considered to be inherent) to one having ordinary skill in the art at the time which the invention was made to determine and correct the subcarrier rotation or phase offset from the single OFDM symbol as suggested by Moose because it would lead to the correct determination of the data in the symbols transmitted.

Regarding claim 8, Moose discloses the limitations of claim 7 as applied above. Further, Moose discloses that the step of determining the subcarrier rotation comprises the step of determining an angle (fig. 8) for a maximum differential correlation (col. 4, lines 23-30) of a frequency-shifted version (col. 4, lines 44-46) of the single OFDM symbol. Moose discloses that a correlation is determined using the single received OFDM timing symbol and the peak or angle is output (fig. 6, ref. 610) to determine the maximum correlation. It is this angle or maximum correlation which is utilized to perform the frequency and phase corrections (fig. 8; col. 5, lines 6-13).

Regarding claim 10, Moose disclose the limitations of claim 1 as applied above. Moose discloses that the correlation output peak is used to update the symbols in the message packet (col. 6, lines 40-45). The updated synchronization determined from the correlation output peak obviously updates any previously determined synchronization

information. One skilled in the art is aware that a RF channel may vary over time. With the timing symbol of each frame, a new synchronization is determined by correlation as disclosed by Moose and it will invariably update any previously determined timing synchronization even if the updating is simply replacing any previous synchronization information. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to update or re-synchronize the synchronization information for each timing symbol in each frame to provide utility for the timing symbol in each frame and to update the synchronization information for a channel which may vary over time.

Regarding claim 17, Moose discloses the limitations of claim 15 as applied above. Further, as applied to claim 7 above, it is at least obvious that the method of Moose additionally comprises the step of determining a subcarrier rotation from the single OFDM symbol.

Regarding claim 18, Moose discloses the limitations of claim 17 as applied above. Further, as applied to claim 8 above, the step of determining the subcarrier rotation comprises the step of determining an angle for a maximum differential correlation of a frequency-shifted version of the single OFDM symbol.

Regarding claim 29, Moose discloses the limitations of claim 25 as applied above. Further, as applied to claim 7 above, it is at least obvious that the apparatus of claim 25 would further comprise a subcarrier rotation synchronizer, operably coupled to the integer subcarrier frequency synchronizer and the timing synchronizer, wherein subcarrier rotation is arranged and constructed to obtain subcarrier rotation

synchronization on the single OFDM symbol. In the apparatus of Moose shown in figure 5, the "Frequency/Timing Recovery" block 506 performs each of the timing synchronization as well as the fractional and integer frequency synchronization. Therefore, the "Frequency/Timing Recovery" block 506 further performs phase synchronization as applied to claim 7 above.

Regarding claim 30, Moose discloses the limitations of claim 25 as applied above. Further, as applied to claim 8 above, the subcarrier rotation synchronizer is further arranged and constructed to determine an angle for a maximum differential correlation of a frequency-shifted version of the single OFDM symbol.

Regarding claim 38, Moose discloses the limitations of claim 34 as applied above. Further, as applied to claims 7 and 8 above, Moose discloses the step of the step of determining subcarrier rotation by determining an angle of a maximum for the differential correlation metric.

Regarding claim 41, Moose discloses a method comprising the steps of: receiving (fig. 5, ref. 501; col. 4, lines 1-15) a single orthogonal frequency division multiplexed (OFDM) symbol (col. 1, lines 50-55) that exhibits 1/N symbol symmetry (col. 1, lines 55-65), where N is an integer greater than or equal to 2 (fig. 3, refs. 304, 306; col. 3, .lines 5-10; col. 3, lines 22-26). Although the method of Moore discloses corrections for timing synchronization, fractional frequency synchronization, and integer frequency synchronization as applied above, subcarrier rotation or phase distortion is cited (col. 5, lines 14-18), but is not explicitly described as being corrected by the disclosure of Moose. However, the inherent relationship between frequency and phase

is well known by one having skill in the art. Further, although it is not explicitly stated by Moose, it is inherent that the phase error or subcarrier rotation of the subcarriers would be *at least partially* determined and corrected by the determination and correction of the frequency error of the subcarriers. One skilled in the art would clearly interpret that the precise correction of the frequency error of the subcarriers as described by Moose would be carried out such that the phase error of the subcarriers would be corrected as well. The determination of the subcarrier frequency offset is a determination of the subcarrier phase offset, and the correction of the subcarrier frequency offset is a correction of the subcarrier phase offset. Therefore, it would have been obvious (if it is not already considered to be inherent) to one having ordinary skill in the art at the time which the invention was made to determine and correct the subcarrier rotation or phase offset from the single OFDM symbol as suggested by Moose because it would lead to the correct determination of the data in the symbols transmitted.

Regarding claim 42, Moose discloses the limitations of claim 41 as applied above. Further, Moose discloses the step of determining timing synchronization (fig. 5, ref. 506; col. 4, lines 17-21) from the single OFDM symbol by applying a correlation metric to the single OFDM symbol (fig. 6A, ref. 606; col. 4, lines 17-26).

Regarding claim 43, Moose discloses the limitations of claim 41 as applied above. Further, Moose discloses the step of determining a fractional subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 5, lines 8-12).

Regarding claim 44, Moose discloses the limitations of claim 41 as applied above. Further, Moose discloses the step of determining an integer subcarrier frequency offset from the single OFDM symbol (col. 4, lines 44-68; col. 6, lines 19-27).

Regarding claim 45, Moose discloses the limitations of claim 41 as applied above. Further, Moose discloses the step of utilizing at least the subcarrier rotation to provide synchronized output symbols in subsequently received bauds (col. 6, lines 40-45). Because the subcarrier frequency synchronization, which is related to subcarrier rotation synchronization, is utilized to provide synchronized outputs in subsequently received bauds, the subcarrier rotation synchronization thereby provides synchronized outputs.

Regarding claim 46, Moose disclose the limitations of claim 41 as applied above. Further, as applied to claim 10 above, Moose discloses that the subcarrier rotation synchronization which is related to the subcarrier frequency synchronization is utilized to update previously determined synchronization information.

Regarding claim 47, Moose discloses the limitations of claim 41 as applied above. Further, Moose discloses that the single OFDM symbol (fig. 3, ref. 204) is an OFDM sync baud or symbol (col. 1, lines 50-65).

Regarding claim 48, Moose discloses the limitations of claim 41 as applied above. Further, Moose discloses that the method is performed by a wireless receiver or RF receiver (col. 4, lines 1-15).

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure. The following prior art of record not relied upon above is cited to further show the state of the art with respect to OFDM receivers.

U.S. Pat. No. 6711221 to Belotserkovsky et al.

U.S. Pat. No. 5329558 to Larsson et al.

U.S. Pat. No. 6058101 to Huang et al.

U.S. Pat. No. 6704374 to Belotserkovsky et al.

U.S. Pat. No. 6807241 to Milbar et al.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M Perilla whose telephone number is (571) 272-3055. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (571) 272-3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason M. Perilla
November 18, 2004

jmp

CHIEH M. FAN
PRIMARY EXAMINER